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Correlation between Independent Variables and Farmers' Knowledge and Adoption Levels of Soil and Water Conservation Practices in Haryana

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Soil and water conservation encompasses essential practices designed to protect agricultural land from degradation. These measures mitigate soil erosion, alleviate soil compaction, manage salinity, and regulate water drainage, thereby maintaining soil fertility and structural integrity. The present study was planned to examine the correlation between various independent variables and the knowledge and adoption levels of farmers regarding soil and water conservation (SWC) practices in Haryana. The study evaluated two distinct agro-climatic regions of Haryana: the eastern (wet) and western (dry) regions. Using a random sampling method, two villages per block and 15 farmers from each village were chosen, constituting a total sample of 240 respondents across 16 villages in 8 blocks from four districts. The analysis revealed that family type, family size, soil type, and irrigation status were non-significantly correlated with the knowledge and adoption levels of the respondents.

Keywords: Irrigation, soil, conservation, farmers, knowledge, adopter, correlation.

Soil and water conservation involves localized activities that maintain or enhance the productive capacity of the land-including soil, water, and vegetation-in areas prone to degradation. These activities focus on the prevention or reduction of soil erosion, compaction, and salinity; the conservation or drainage of water; and the maintenance or improvement of soil fertility (Liniger & Critchley, 2007). The primary purposes of adopting SWC practices are to control runoff, thereby preventing soil loss, reducing soil compaction, and maintaining optimal soil fertility (Bashir et al., 2017).

Effective SWC practices are critical for retaining soil moisture and minimizing erosion. Research indicates that a majority of farmers (62.96%) acknowledge the severity of soil erosion (Shehrawat et al., 2023). Furthermore, conservation initiatives become significantly more cost-effective when they are aligned with an understanding of farmers' perceptions and the specific conditions under which they adopt and maintain SWC structures (Shankar et al., 2007). Understanding indigenous methods of conservation and adoption patterns among farmers is crucial for evaluating their utility and scope for further improvement (Kerr & Sanghi, 1992). In Haryana, several SWC practices are currently being adopted, including specific sowing directions, modified cropping systems, mulching, green manuring, agronomic measures, vegetative barriers, watershed management, and micro-irrigation (Shehrawat et al., 2023).

The total geographical area of Haryana is 4.42 million hectares (m ha), of which 82.60% is cultivable. Notably, 3.06 m ha of this cultivable land is affected by soil erosion, with approximately one-third of the state's cultivable area prone to high or very high erosion rates (Department of Economic and Statistical Analysis, 2022). Haryana is geographically divided into two primary agro-climatic zones. The eastern region is relatively wet, receiving between 600 and 1100 millimeters of rainfall annually, and encompasses districts such as Yamunanagar, Kurukshetra, Karnal, and Kaithal. The western region is dry, receiving only 300 to 450 millimeters of rainfall, and includes Sirsa, Hisar, Fatehabad, and Bhiwani. In the eastern region, soil deterioration is primarily driven by intense cropping patterns and water erosion, whereas the western region is highly susceptible to wind erosion. Historically, erosion rates on the alluvial Indo-Gangetic Plains, including Haryana, were classified as moderate (5-10 t/ha/year) in 1992 (Singh et al., 1992) but recent assessments indicate an increase to 0-5 t/ha/year in 2022 (Jha et al., 2022). To address these challenges, institutions under the Natural Resource Management (NRM) Division of the Indian Council of Agricultural Research (ICAR)-such as ICAR-IISWC, CRIDA, CSSRI, and CAZRI-focus extensively on SWC research tailored to these respective regions.

Objectives of the Study

- To evaluate the baseline knowledge of farmers regarding specific soil and water conservation (SWC) practices.
- To quantify the extent to which these farmers have adopted the aforementioned SWC practices.

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- To identify the primary constraints hindering the implementation of these practices, thereby informing future strategies for sustainable agricultural development.

Method

Study Area

To facilitate a robust comparative analysis of farmers' implementation and understanding of soil and water conservation (SWC) strategies, this research was situated across two ecologically contrasting zones within Haryana. The first area, designated as Zone-I (the eastern wet region), encompasses the Kurukshetra and Karnal districts. This zone experiences substantial annual precipitation, averaging between 580 mm and 1100 mm, which, combined with robust groundwater accessibility and nutrient-rich alluvial soils, sustains heavily irrigated, water-dependent agriculture (Central Ground Water Board, 2013a, 2013b). Conversely, Zone-II (the western dry region), which includes the Bhiwani and Hisar districts, faces significant ecological constraints. Characterized by frequent moisture deficits, deeper groundwater tables, and diminished soil fertility, this zone receives only 300 mm to 450 mm of rainfall annually (Central Ground Water Board, 2012, 2017). The substantial agro-ecological disparities between these two zones establish an optimal framework for assessing regional variations in the adoption of SWC practices.

Procedure

A multi-stage random sampling design was employed to select the respondents for this investigation. In the first stage, Haryana was purposively stratified into the two aforementioned contrasting agro-climatic zones. In the second stage, two districts were randomly selected from each zone: Kurukshetra and Karnal from Zone-I, and Hisar and Bhiwani from Zone-II. The third stage involved the random selection of two administrative blocks from each district: Karnal and Nilokheri (Karnal), Shahbad and Ladwa (Kurukshetra), Bhiwani and Tosham (Bhiwani), and Hisar-I and Hansi-I (Hisar). Subsequently, two villages were randomly selected per block. In the final stage, 15 farmers were chosen at random from each of the 16 selected villages, resulting in a total, representative sample size of 240 respondents.

Data Collection

Primary data were acquired utilizing a standardized, pre-tested interview schedule. To ensure accuracy and contextual relevance, individual face-to-face interviews were conducted on-site at the respondents' agricultural fields and residences. This survey instrument was specifically designed to evaluate the farmers' socioeconomic profiles, their baseline comprehension of SWC strategies, their current adoption levels, and the primary constraints inhibiting further implementation.

Statistical Analysis

Upon completion of the field surveys, the acquired data were systematically coded, tabulated, and subjected to rigorous statistical evaluation. Descriptive statistics-specifically frequencies, percentages, arithmetic means, and standard deviations-were computed to summarize the demographic and baseline variables. Furthermore, inferential statistical techniques, including correlation and regression analyses, were employed to quantify the relationships between the independent variables and the respondents' knowledge and adoption levels. All statistical procedures were executed utilizing a standard statistical software package. (Editor's Note: You must insert the specific software name and version here, e.g., IBM SPSS Statistics version 26.0, to ensure full methodological transparency).

Results and Discussion

Correlation between Respondents' Knowledge Level and Independent Variables

Pearson's correlation coefficients were computed to quantify the associations between the seventeen selected socio-economic of soil and water conservation (SWC) practices (Table 1).

Table 1

Correlation between Respondents' Knowledge Level and Various Independent Variables

Sr. No.	Independent Variable	Correlation Coefficient
1	Age	-0.385
2	Education	0.291
3	Family type	0.115 (NS)
4	Family size	0.152 (NS)
5	Occupation	0.162*
6	Family Income (Annual)	0.495
7	Land Holding	0.299
8	Soil type	0.102 (NS)
9	Topography of land	0.102*
10	Cropping System	0.128*
11	Irrigation Status	0.142 (NS)
12	Farming Experience	0.199*
13	Social Participation	0.437
14	Farm Power	0.351*
15	Mass Media Exposure	0.351
16	Extension Contacts	0.653
17	Risk Orientation	0.599

Note. NS = Non-significant * = Significant at the 0.05 level ** = Significant at the 0.01 level

The statistical analysis revealed substantial variations in how specific demographic and economic factors influence SWC knowledge. Notably, age demonstrated a significant, negative correlation with knowledge levels ($r = -0.385$, $p < 0.01$). Conversely, highly significant positive correlations ($p < 0.01$) were observed for education ($r = 0.291$), annual family income ($r = 0.495$), land holding size ($r = 0.299$), social participation ($r = 0.437$), mass media exposure ($r = 0.351$), extension contacts ($r = 0.653$), and risk orientation ($r = 0.599$). Additionally, occupation ($r = 0.162$), land topography ($r = 0.102$), cropping system ($r = 0.128$), farming experience ($r = 0.199$), and farm power ($r = 0.351$) exhibited positive and significant relationships with SWC knowledge at the 0.05 level. Variables reflecting fundamental household and geographical baseline characteristics-specifically family type ($r = 0.115$), family size ($r = 0.152$), soil type ($r = 0.102$), and irrigation status ($r = 0.142$)-were found to be non-significantly correlated with the respondents' knowledge.

Correlation between Respondents' Adoption Level and Independent Variables

The associations between the independent variables and the

actual implementation of SWC practices were similarly evaluated (Table 2). Consistent with the knowledge parameters, age exhibited a significant negative correlation with the adoption level (r = -0.308, $p < 0.01$). In contrast, robust positive correlations ($p < 0.01$) were established for education (r = 0.233), annual family income (r = 0.396), land holding (r = 0.239), social participation (r = 0.350), mass media exposure (r = 0.281), extension contacts (r = 0.522), and risk orientation (r = 0.479). Furthermore, significant positive correlations at the 0.05 level were recorded for occupation (r = 0.130), topography (r = 0.130), cropping systems (r = 0.102), farming experience (r = 0.159), and farm power (r = 0.281). Family type (r = 0.092), family size (r = 0.122), soil type (r = 0.082), and irrigation status (r = 0.128) failed to show any statistically significant relationship with adoption rates. These empirical outcomes align closely with previously documented adoption behaviors in related agricultural sectors (Bunkar, 2018; Naik & Patil, 2019; Rohila et al., 2017).

Table 2

Correlation between Respondents' Adoption Level and Independent Variables

Sr. No.	Independent Variable	Correlation Coefficient
1.	Age	-0.308**
2.	Education	0.233**
3.	Family type	0.122NS
4.	Family Size	0.122NS
5.	Occupation	0.130*
6.	Family income (Annual)	0.239**
7.	Land Holding	0.082NS
8.	Soil type	0.130*
9.	Topography of land	0.102*
10.	Cropping System	0.128NS
11.	Irrigation Status	0.159*
12.	Farming Experience	0.350**
13.	Social Participation	0.281*
14.	Farm Power	0.281*
15.	Mass Media Exposure	0.522**
16.	Extension Contacts	0.479**
17.	Risk Orientation	0.479**

Note. NS = Non-significant, * = Significant at the 0.05 level, ** = Significant at the 0.01 level

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